June 8th Meeting Presentation

Competing Risks Models: Cause-specific hazards and cumulative incidence function Models

Cause-Specific Hazard (CSH)

Instantaneous rate of occurence of a given event among patients still event-free

Modelled by the Cox-Proportional Hazards model and the Multinomial Casebase model

Cumulative Incidence Function (CIF)

Probability of occurrence of a given event by time t i.e the expected proportion of patients with a certain event over the course of time

Modelled by the direct Binomial and Fine-Gray model

What do we want to infer in a competing risks model?

A complete competing risks analysis involves inferring both the cause-specific hazard ratio as well as the cumulative incidence functions

To show from a competing risks model

- It can perform variable selection as accurately as a cox proportional hazards model
- It can estimate CIF curves as accurate as a direct binomial or Fine-Gray approach and relatively better than the Cox-proportional hazards non-parametric estimate

Simulation Settings

- Data generated from two proportional hazards models:
- Simulation Settings

  The cause-specific hazards of the outcome of interest and the competing risk follow proportional hazards models, specifically:

$$\alpha_{01} = 0.8t \exp(\beta_{01} Z)$$

$$\alpha_{02} = 0.3t \exp(\beta_{02} Z)$$

- where both cause-specific hazards have the form of a Weibull distribution and a common set of covariates.

N = 400, p = 20

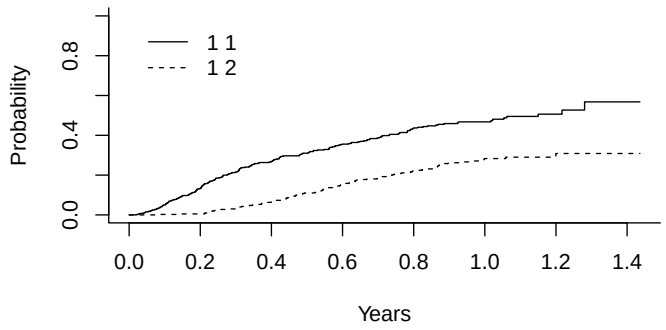
Three correlation cases: IID, AR(1) correlation ($\rho = 0.5$) and Block Correlation

Block correlation - 4 blocks, correlations of 0.5, 0.35, 0.05 and 0.32

Three cases of sparsity: (1) Sparse: Predictors 1 and 10 (2) Midsparse: Predictors 1, 5, 10 and 15 and Non-sparse (3) predictors 1, 2, 3, 5, 8, 10, 13, 15, 18, 20

Betas for cause of interest: 0.5, Betas for competing risk: 0.2

Approximately ~ 25 % censorings, 55 % of the cause of interest and 20 for the competing cause



Variable Selection Results: N > p IID and Sparse case

Model	Mean Sp	Mean Se	Median Sp	Median Se	Miss Rate	MCC
casebase..0.5se	1 (0)	0 (0)	1 (0)	0 (0)	1.000	NaN
casebase..1se	1 (0)	0 (0)	1 (0)	0 (0)	1.000	NaN
casebase..min	0.95 (0.058)	0.384 (0.239)	0.944 (0.056)	0.5 (0.5)	0.257	0.437
casebase..min0.5se	0.765 (0.148)	0.578 (0.244)	0.778 (0.222)	0.5 (0)	0.052	0.269
casebase..min1se	0.61 (0.164)	0.661 (0.251)	0.611 (0.222)	0.5 (0.5)	0.016	0.181
cox	0.453 (0.147)	0.753 (0.25)	0.444 (0.222)	1 (0.5)	0.000	0.129

Variable Selection Results: N > p IID and Mid-sparse case

Model	Mean Sp	Mean Se	Median Sp	Median Se	Miss Rate	MCC
casebase..0.5se	1 (0)	0 (0)	1 (0)	0 (0)	1.000	NaN
casebase..1se	1 (0)	0 (0)	1 (0)	0 (0)	1.000	NaN
casebase..min	0.948 (0.073)	0.179 (0.126)	1 (0.067)	0.2 (0)	0.223	0.249
casebase..min0.5se	0.79 (0.155)	0.351 (0.187)	0.8 (0.2)	0.4 (0.2)	0.008	0.170
casebase..min1se	0.643 (0.175)	0.466 (0.219)	0.667 (0.2)	0.4 (0.4)	0.004	0.110
cox	0.445 (0.179)	0.621 (0.225)	0.467 (0.2)	0.6 (0.4)	0.000	0.061

Variable Selection Results: N > p IID and Non-sparse case

Model	Mean Sp	Mean Se	Median Sp	Median Se	Miss Rate	MCC
casebase..0.5se	0.693 (0.2)	0.357 (0.194)	0.7 (0.2)	0.3 (0.3)	0.056	0.058
casebase..1se	0.778 (0.167)	0.268 (0.171)	0.8 (0.2)	0.3 (0.3)	0.100	0.059
casebase..min	0.531 (0.205)	0.514 (0.204)	0.6 (0.3)	0.5 (0.3)	0.024	0.046
casebase..min0.5se	0.363 (0.194)	0.67 (0.19)	0.4 (0.3)	0.7 (0.3)	0.064	0.037
casebase..min1se	0.289 (0.186)	0.733 (0.174)	0.3 (0.2)	0.7 (0.3)	0.116	0.024
cox	0.465 (0.191)	0.599 (0.172)	0.5 (0.3)	0.6 (0.2)	0.004	0.067

Variable Selection Results: N > p AR(1) correlation and Sparse case

Model	Mean Sp	Mean Se	Median Sp	Median Se	Miss Rate	MCC
casebase..0.5se	0.996 (0.047)	0.008 (0.078)	1 (0)	0 (0)	0.988	0.377
casebase..1se	0.997 (0.046)	0.004 (0.064)	1 (0)	0 (0)	0.996	0.192
casebase..min	0.954 (0.075)	0.393 (0.229)	1 (0.056)	0.5 (0)	0.234	0.474
casebase..min0.5se	0.852 (0.12)	0.543 (0.201)	0.889 (0.167)	0.5 (0)	0.041	0.351
casebase..min1se	0.744 (0.142)	0.617 (0.231)	0.778 (0.167)	0.5 (0.125)	0.016	0.264
cox	0.555 (0.152)	0.75 (0.255)	0.556 (0.222)	1 (0.5)	0.004	0.193

Variable Selection Results: N > p AR(1) correlation and Mid-sparse case

Model	Mean Sp	Mean Se	Median Sp	Median Se	Miss Rate	MCC
casebase..0.5se	0.999 (0.017)	0.002 (0.029)	1 (0)	0 (0)	0.992	0.262
casebase..1se	1 (0)	0 (0)	1 (0)	0 (0)	1.000	NaN
casebase..min	0.948 (0.072)	0.177 (0.111)	1 (0.067)	0.2 (0)	0.202	0.241
casebase..min0.5se	0.847 (0.12)	0.282 (0.151)	0.867 (0.133)	0.2 (0.2)	0.037	0.171
casebase..min1se	0.726 (0.158)	0.4 (0.192)	0.733 (0.267)	0.4 (0.4)	0.004	0.135
cox	0.531 (0.158)	0.547 (0.208)	0.533 (0.133)	0.6 (0.2)	0.000	0.072

Variable Selection Results: N > p AR(1) correlation and Non-sparse case

Model	Mean Sp	Mean Se	Median Sp	Median Se	Miss Rate	MCC
casebase..0.5se	0.806 (0.185)	0.263 (0.183)	0.9 (0.2)	0.2 (0.3)	0.076	0.095
casebase..1se	0.866 (0.147)	0.193 (0.157)	0.9 (0.2)	0.2 (0.2)	0.167	0.096
casebase..min	0.657 (0.219)	0.427 (0.226)	0.7 (0.25)	0.4 (0.3)	0.028	0.095
casebase..min0.5se	0.486 (0.224)	0.585 (0.209)	0.5 (0.25)	0.6 (0.3)	0.056	0.079
casebase..min1se	0.396 (0.218)	0.666 (0.198)	0.4 (0.3)	0.7 (0.3)	0.092	0.070
cox	0.533 (0.191)	0.541 (0.167)	0.5 (0.3)	0.5 (0.2)	0.008	0.077

Variable Selection Results: N > p Block correlation and Sparse case

Model	Mean Sp	Mean Se	Median Sp	Median Se	Miss Rate	MCC
casebase..0.5se	0.817 (0.139)	0.5 (0.196)	0.778 (0.222)	0.5 (0)	0.071	0.288
casebase..1se	0.817 (0.139)	0.5 (0.196)	0.778 (0.222)	0.5 (0)	0.071	0.288
casebase..min	0.813 (0.146)	0.5 (0.196)	0.778 (0.222)	0.5 (0)	0.071	0.286
casebase..min0.5se	0.659 (0.167)	0.643 (0.234)	0.639 (0.222)	0.5 (0.375)	0.000	0.210
casebase..min1se	0.437 (0.182)	0.643 (0.234)	0.389 (0.222)	0.5 (0.375)	0.000	0.052
cox..0.5se	0.861 (0.075)	0.5 (0)	0.889 (0.056)	0.5 (0)	0.000	0.305
cox..1se	0.972 (0.036)	0.5 (0)	1 (0.056)	0.5 (0)	0.000	0.575
cox..min	0.548 (0.189)	0.643 (0.234)	0.611 (0.25)	0.5 (0.375)	0.000	0.121
cox..min0.5se	0.234 (0.165)	0.857 (0.234)	0.222 (0.264)	1 (0.375)	0.071	0.077
cox..min1se	0.099 (0.09)	0.929 (0.182)	0.083 (0.056)	1 (0)	0.214	0.029

Variable Selection Results: N > p Block correlation and Mid-sparse case

Model	Mean Sp	Mean Se	Median Sp	Median Se	Miss Rate	MCC
casebase..0.5se	0.779 (0.148)	0.312 (0.126)	0.8 (0.167)	0.3 (0.2)	0.000	0.125
casebase..1se	0.775 (0.148)	0.312 (0.126)	0.767 (0.167)	0.3 (0.2)	0.000	0.120
casebase..min	0.779 (0.148)	0.312 (0.126)	0.8 (0.167)	0.3 (0.2)	0.000	0.125
casebase..min0.5se	0.583 (0.183)	0.45 (0.2)	0.567 (0.233)	0.4 (0.2)	0.000	0.038
casebase..min1se	0.404 (0.198)	0.675 (0.218)	0.4 (0.283)	0.6 (0.25)	0.000	0.076
cox..0.5se	0.788 (0.129)	0.288 (0.126)	0.8 (0.15)	0.2 (0.2)	0.000	0.106
cox..1se	0.921 (0.082)	0.2 (0)	0.933 (0.133)	0.2 (0)	0.000	0.218
cox..min	0.529 (0.13)	0.6 (0.193)	0.533 (0.217)	0.6 (0.1)	0.000	0.113
cox..min0.5se	0.262 (0.118)	0.85 (0.186)	0.3 (0.15)	0.9 (0.2)	0.062	0.124
cox..min1se	0.133 (0.081)	0.912 (0.126)	0.133 (0.133)	1 (0.2)	0.125	0.078

Variable Selection Results: N > p Block correlation and Non-sparse case

Model	Mean Sp	Mean Se	Median Sp	Median Se	Miss Rate	MCC
casebase..0.5se	0.877 (0.13)	0.2 (0.238)	0.9 (0.2)	0.1 (0.2)	0.231	0.117
casebase..1se	0.931 (0.095)	0.131 (0.218)	1 (0.1)	0.1 (0.1)	0.385	0.111
casebase..min	0.662 (0.139)	0.4 (0.204)	0.7 (0.1)	0.3 (0.2)	0.000	0.064
casebase..min0.5se	0.362 (0.194)	0.723 (0.148)	0.3 (0.3)	0.7 (0.3)	0.000	0.097
casebase..min1se	0.238 (0.218)	0.808 (0.138)	0.2 (0.3)	0.8 (0.2)	0.154	0.052
cox..0.5se	0.769 (0.144)	0.346 (0.145)	0.8 (0.2)	0.3 (0.2)	0.000	0.133
cox..1se	0.962 (0.051)	0.146 (0.066)	1 (0.1)	0.2 (0.1)	0.077	0.203

Model	Mean Sp	Mean Se	Median Sp	Median Se	Miss Rate	MCC
cox..min	0.485 (0.141)	0.531 (0.16)	0.5 (0.2)	0.5 (0)	0.000	0.020
cox..min0.5se	0.292 (0.112)	0.754 (0.127)	0.3 (0.2)	0.8 (0.3)	0.000	0.057
cox..min1se	0.185 (0.114)	0.846 (0.12)	0.2 (0.1)	0.9 (0.1)	0.154	0.050

Next Steps

1. Focus on Brier score simulation results and p > N variable selection results - generate by next week
2. Apply method on real dataset?: Microarray data for non-Muscle Invasive Bladder Carcinoma